The Laboratory for Terrestrial Physics

2001 Annual Report

NASA Goddard Space Flight Center
Greenbelt, MD 20771

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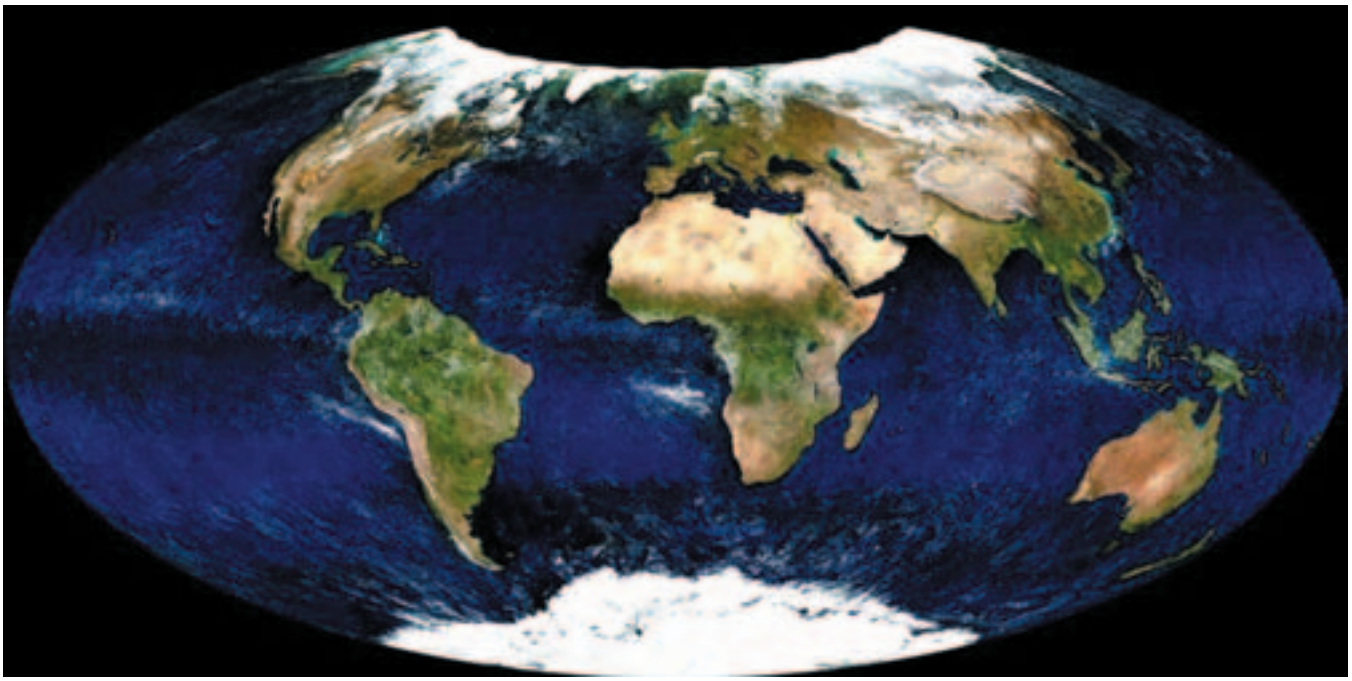

The image on the cover of the Laboratory's annual report for 2001 was produced from the MODIS Monthly Land Surface Reflectance product for November 2000. The atmospherically corrected land surface reflectance product is the basis upon which land products such as vegetation indices, land cover change and net primary productivity are derived. Dr. Eric Vermote, a faculty member at the University of Maryland who developed this product, is affiliated with the Biospheric Sciences and Information Systems Branches of this Laboratory.

The MODIS (Moderate-resolution Imaging Spectroradiometer) is the key sensor on both the EOS Terra and EOS Aqua spacecraft. Each day the MODIS instrument provides nearly full global coverage at spatial resolutions from 250m to 1km. Raw data collected in thirty-six spectral bands is used to produce 44 products used by scientists studying changes globally, on land and in the oceans and atmosphere.

In 2001, MODIS products were produced with improved science algorithms for the period from October 2000 through December 2001. On average over 1,200 billion bytes of data products were generated each day by the MODIS Adaptive Processing System (MODAPS) developed and operated by this Laboratory. In addition to producing MODIS science products, scientists in this Laboratory have calibrated and characterized the instrument, led the testing and integration of science software into production systems, assessed product quality and led field experiments to validate MODIS product accuracy.

This year also saw the Laboratory's development of data systems for near real-time MODIS data production. The first was a system for fire detection and fire mapping, Rapidfire, developed in collaboration with the University of Maryland and the US Forest Service. The second was a near-real time processing system for NOAA used for rapid generation of daily MODIS products for Air Force mission planning and fishery and wildlife habitat monitoring.

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Introduction

Thank you for taking the time to acquaint yourself with the Laboratory for Terrestrial Physics and our accomplishments for 2001!

The Laboratory advances NASA programs through the exploration of Earth and planetary solid-body physics. These explorations involve the physics and dynamics of the Earth, as well as of the planets and their satellites. The Lab's innovative and exciting programs study the global properties of the solid Earth, global and regional scale vegetation monitoring, biosphere-atmosphere interactions, and laser remote sensing.

The Laboratory's Biospheric Sciences program encompasses a broad range of basic and applied research to study terrestrial ecosystems and their interactions with the atmosphere using multi-scale remote sensing, modeling, and advanced analytical techniques. Experiments and investigations utilizing new techniques and capabilities enhance our understanding of global processes for Earth System Science.

The Laboratory's "geophysical and geodynamic" studies span a wide range of subjects in the research of both the Earth and solid planetary bodies, especially Mars. Present-day measurements using both surface and satellite data, models derived from these, and other observational and theoretical information, are used to help improve our understanding of the evolution of the core, mantle and crust, and their interactions with surface topography.

The Laboratory's laser measurement research studies new techniques based on analysis and tests with airborne and spaceborne instruments. Accordingly, this area links the scientific requirements to define, design, build, and demonstrate instruments for Earth and planetary remote-sensing science programs. The laser research itself is focused on improving the understanding of electo-optical sensor physics, and the propagation environment. Additional technological skills are employed in the development of advance techniques for defining subsystem performance through the development and engineering of flight instruments, and the calibration and characterization of these instruments in realistic environments.

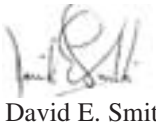
The Laboratory's information processing research focuses on developing reliable, low-cost computing systems for the production, distribution, and analysis of regional and global data sets. The Laboratory's information technology improves the security and reliability of the computing environment.

Ultimately, our activities result in the advance of scientific knowledge. To this point, the Laboratory relies on its key personnel - its scientists and researchers - to report their results in conferences, symposia, and publications. Interaction with the national and international scientific community is essential, and integrally a part of our Laboratory's efforts.

This comprehensive report includes our philosophy, an overview of our dedicated staff, and descriptions of our projects, with synopses of the Laboratory's achievements and accomplishments for 2001. This report encompasses the Laboratory's dedication to human resources, their scientific interactions, and outreach activities with the outside community.

Please take some time to peruse this report, and contact me or my staff if you have any questions, concerns, or comments.

Sincerely,



David E. Smith
Chief, Laboratory for Terrestrial Physics

Our Mission and Place within NASA

Mission: The Laboratory for Terrestrial Physics is dedicated to the advancement of knowledge in Earth and planetary science, by conducting innovative research using space technology.

The Laboratory's mission and activities support the work and new initiatives at NASA's Goddard Space Flight Center (GSFC). The Laboratory's success contributes to the Earth Science Directorate as a national resource and a Center of Excellence for studies of Earth from Space. The Laboratory is part of the Earth Science Directorate based at the GSFC in Greenbelt, MD. The Directorate itself is comprised of the Global Change Data Center (GCDC), the Space Data and Computing Division (SDCD), and four science Laboratories, including Laboratory for Terrestrial Physics, Laboratory for Atmospheres, and Laboratory for Hydrospheric Processes all in Greenbelt, MD. The fourth research organization, Goddard Institute for Space Studies (GISS), is in New York, NY.

Relevant to NASA's Strategic Plan (September 2000), the Laboratory ensures that all work undertaken and completed is within the vision of GSFC. The philosophy of the Laboratory is to balance the completion of near term goals, while building on the Laboratory's achievements as a foundation for the scientific challenges in the future.

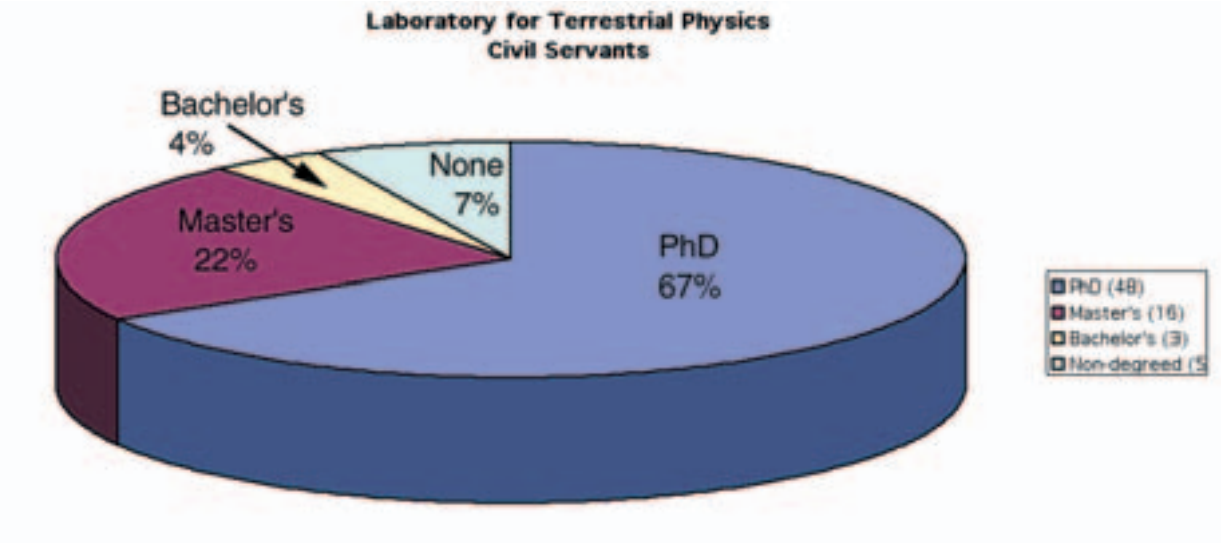
For your convenience, we have published this report on the Internet at the following link: http://ltpwww.gsfc.nasa.gov/

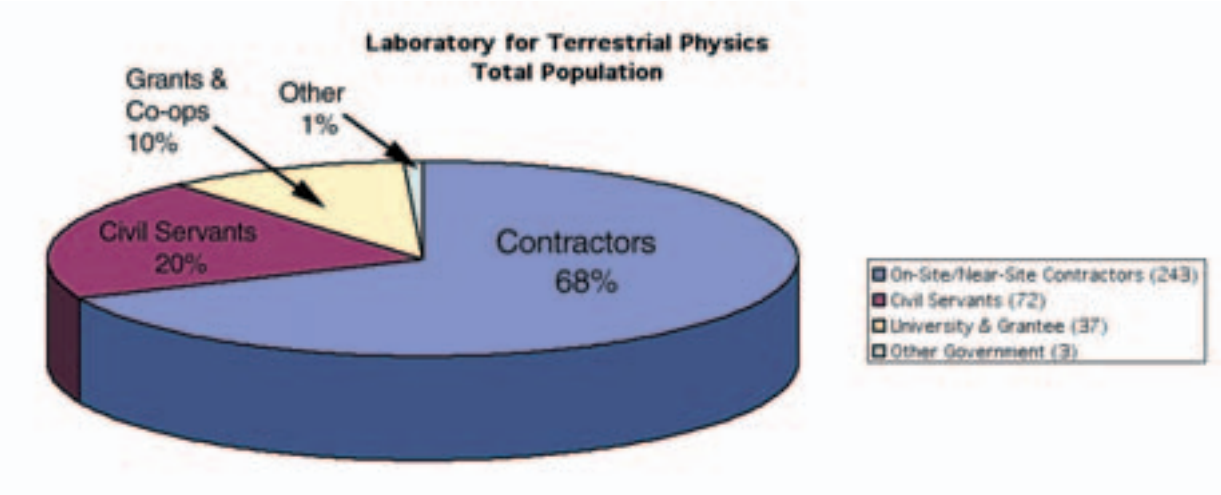
Organizational Structure

The Laboratory for Terrestrial Physics is one of 3 scientific divisions within the Earth Sciences Directorate, sharing research with the Laboratory for Hydrospheric Processes and Laboratory for Atmospheres, and the Goddard Institute for Space Studies.

Staff

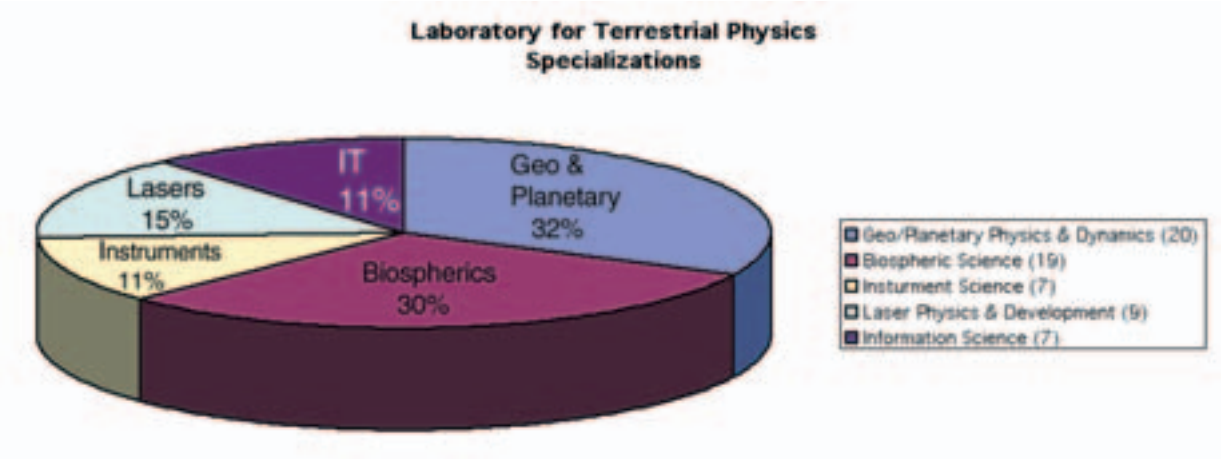
The Laboratory hosts 72 civil servants (67 full-time permanent), and 243 supporting contractors, which are on site or near site. University grants and cooperative agreements draw 37 additional scientists and technologists. There are 3 additional employees from other government agencies who are long-term residents within the Laboratory. The average age of a Laboratory civil servant is 50, and the average age of all professionals is 51. Ages range from 26 (secretary) or 33 (researcher) to 76. For the civil servants within the Laboratory, the average length of government service is over 20 years; a majority of those have spent their entire time within the Laboratory. This may be taken as an indicator that the Laboratory is a "good place to work".



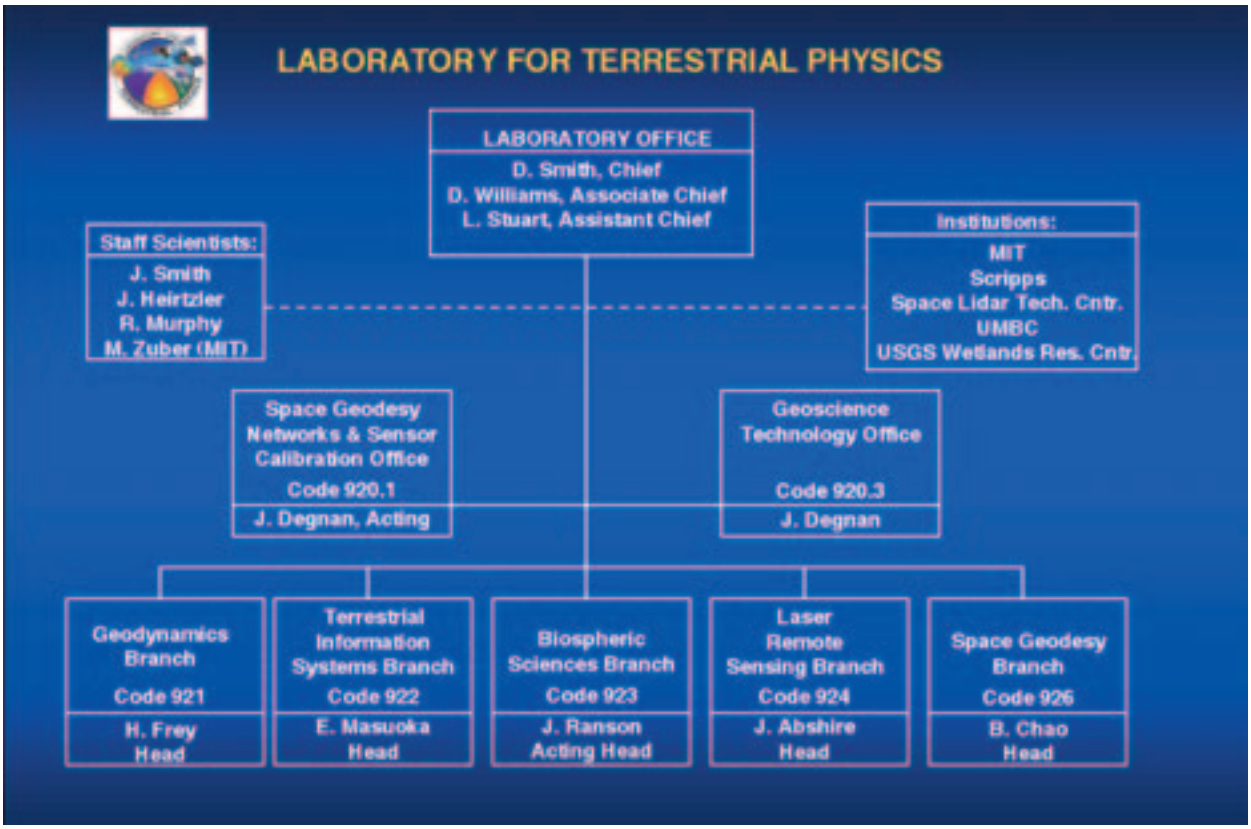


Organizational Structure

There are many different professional skills represented within the Laboratory. As a gross summary, there are 20 researchers in geo/planetary physics and dynamics; 19 in biospheric sciences; 9 in laser physics and development; and 7 each in instrument science and information science. Additionally, there are 10 employees who devote the majority of their time to administrative tasks, from project science to office administration.



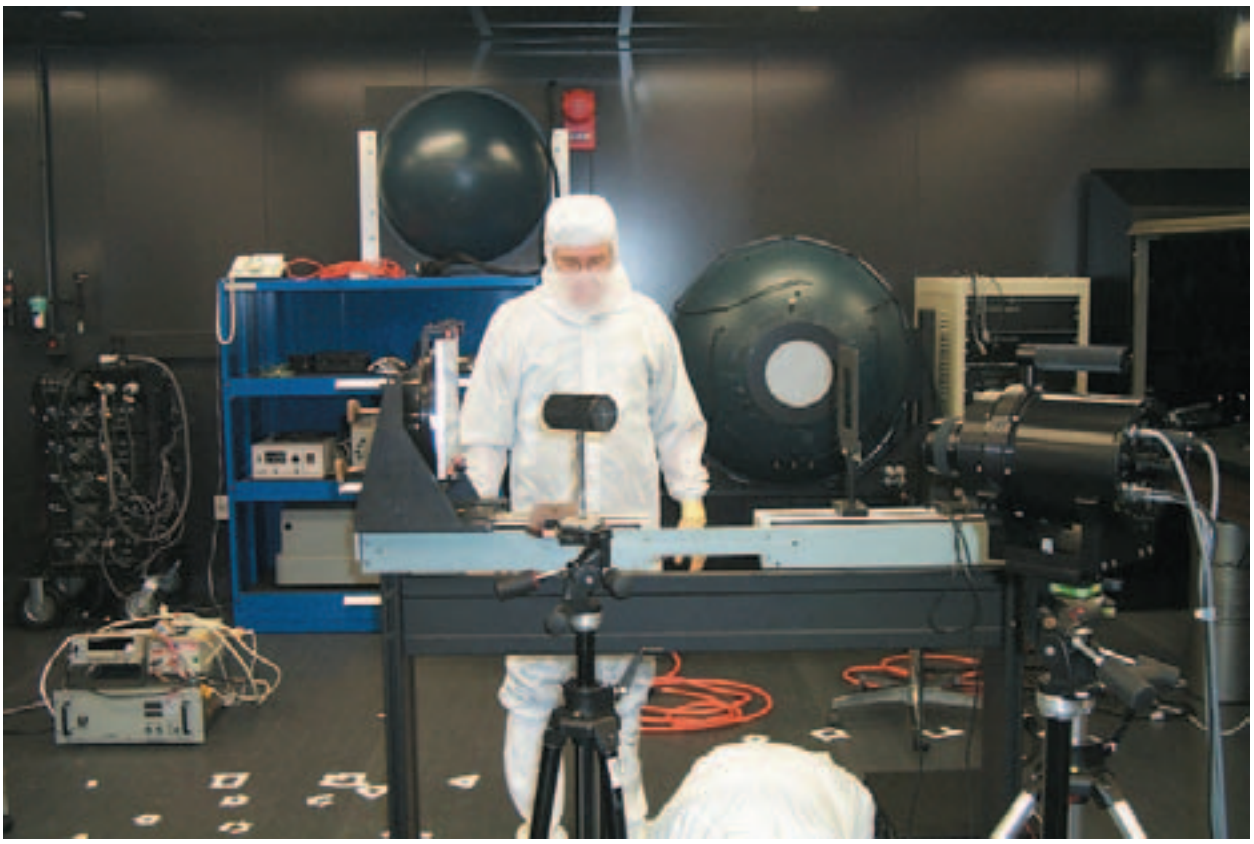
The Laboratory is composed of 5 branches, 2 offices, 4 staff scientists, and a large number of cooperating institutions. Particularly notable in the latter category are MIT, University of Maryland at College Park, University of Maryland Baltimore Campus; Scripps Institute of Oceanography (one Laboratory employee is permanently located there), the U.S. Geological Survey, and International Laser Ranging and Very Long Baseline Interferometer services. Branches range in size from 7 to 20 employees; offices from 3 to 5.



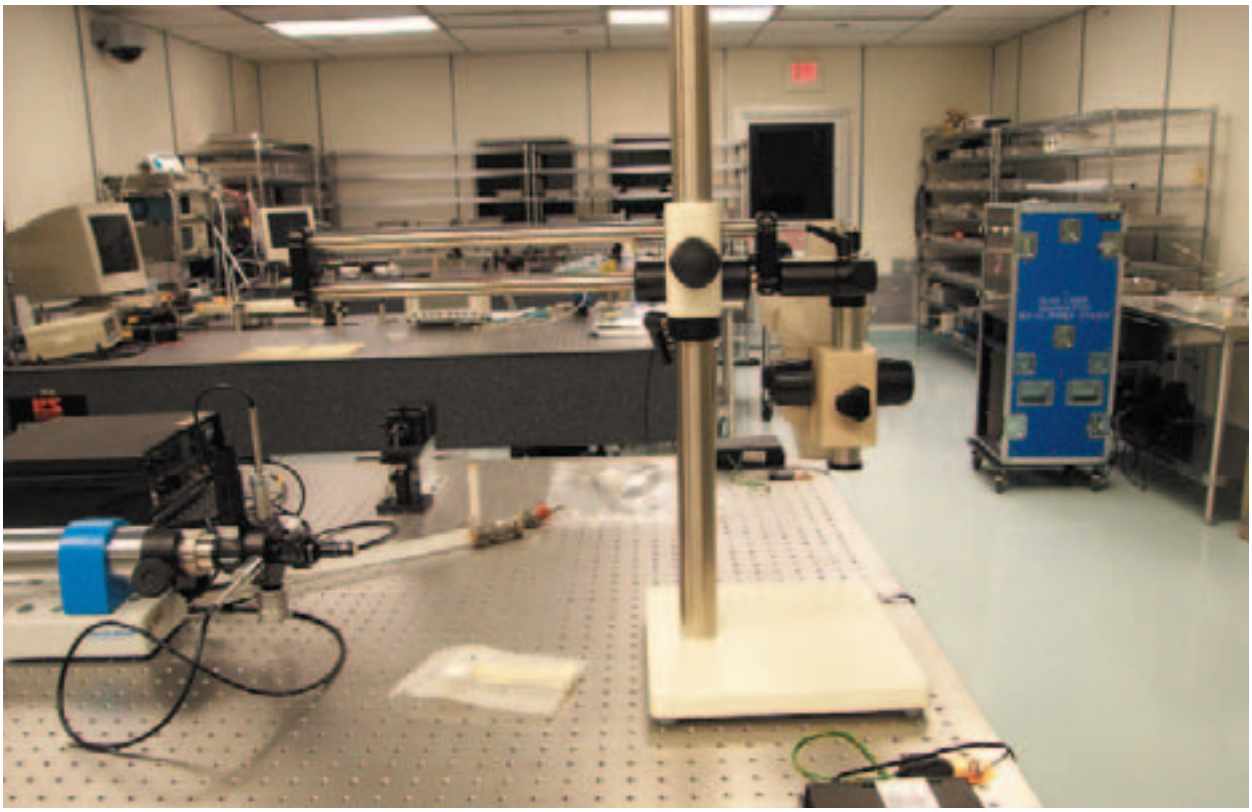
Facilities

Facilities are both sophisticated and diverse. There are "wet" and "dry" labs, and computer facilities, connected with Biospheric Science. Information Systems boasts a large computer center capable of processing one of the largest and most complex streams of data from space, as well as another center which provides computational and graphic services for all Laboratory personnel. Laser labs and facilities are involved in pioneering research in laser theory and design, and in building and operating lasers for surface, aircraft, and spacecraft deployment. Instrument calibration facilities are carefully maintained and uniquely or precisely instrumented. Many facilities are here at Goddard; others are nearby, and still others (i.e., satellite laser ranging) are located globally.

Some examples of facilities are shown below.



Visible Spectrum Instrument Calibration Facility



Space Flight Laser Assembly and Test Clean Room

Mechanical Laboratory With 4 Axis Precision

MODIS Data Processing System Computer Facility

Laser Detector Characterization Laboratory

Laser Testing Vacuum Chamber at the Space Lidar Technology Center

Satellite Laser Ranging Automated Tracking Facility

Laboratory Safety

The Laboratory is committed to maintaining a safe environment for its employees. This is accomplished through the appointment of a Laboratory Safety Officer, and the formation of a Laboratory Safety Committee, with representatives from each organizational unit.

Office safety concentrates on maintaining a healthy, accident-free environment, with concerns about ergonomics, combustible loading, free sprinkler system access, falling objects, and non-restricted egress.

Safety of laboratories depends upon proper use and storage of chemicals, laser containment and safeguards, electrical protection, careful maintenance of clean rooms, and all the components involved in office safety.

The Laboratory is pleased to announce that there have been no lost days, nor damaged major equipment, due to accidents in the past year.